Concepts for adoption and impact studies for the CRP Livestock - Strategic Investment Fund

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# Introduction

The assessment of adoption and impact of technologies linked to previous CG investments is a major objective pursued by CRP Livestock’s Strategic Investment Fund (SIF) in 2017 and 2018. This document proposes four research studies which appear suitable for this objective. Two of these focus on adoption and its measurement while the other two aim to investigate household-level impacts of adopting the promoted technologies, with one of these also including a strong adoption component. They have been selected for being based on previous research work by CG centres, their relevance for SDG-oriented development efforts and their suitability for rigorous assessment. All four studies are aimed at the development and dissemination of forages.

The potential of feed improvements to transform livestock productivity is often underrated in comparison to other livestock-oriented technologies, making research into their adoption and impact a priority for SIF funding. An addition, feed-oriented CG research has generated specific products and technologies, which can be identified, tracked and assessed from development to adoption by livestock producers. Recent CG research into animal health and genetic improvements offer fewer such opportunities, because the research is either located too far up-stream to show direct links to adoption and impact (e.g. research into vaccine development), or it is closely integrated into broader development activities, limiting the opportunities to identify the CG-specific technology contribution (e.g. supporting the adoption of artificial insemination).

Candidate studies have also been selected for the collaborative nature of their research implementation plans. Fodder-related research is especially attractive in this regard as it entails close co-operation across several CG centres as well as with local partners.

Finally, the candidate studies have been selected to provide a variety of assessment approaches, from focussing on technical, economic and political determinants of adoption, over adoption measurement issues to impacts of adoption on livelihoods measured by various indicators of development and well-being.

The sequence of the candidate studies presented here suggests a prioritisation and sequence within the two-year time horizon envisaged for this funding. Thus, the priorities represent a combination of integrating the studies into the overall research environment of the CRP Livestock and the participating CG centres, the urgency of generating the expected research results as well as the scientific importance of these results. The two studies planned to be initiated in 2017 are developed in greater detail, with the other two studies presented as concepts, to be further developed when the CRP Livestock’s research strategy and funding for 2018 and 2019 becomes clearer.

In order to ensure a research design most appropriate for each study’s objectives and context, the studies are split into two distinct phases: The initial design phase includes the development of detailed hypotheses, the selection of appropriate analysis procedures, the review and assembly of existing data for sampling and analysis simulation and the establishment of research partnerships, resulting in the formulation of an efficient research design and implementation plan. The review of outputs generated in the first phase of each of the proposed studies will be carried out in collaboration with the CGIAR’s Standing Panel on Impact Assessment (SPIA) and the Royal Tropical Institute (KIT). During the second phase of the studies the developed plans will be executed, mainly through implementing data collection and analysis. For each study, budget approval of the second phase will be based on the review of the first phase.

# A global approach to improving the estimation of forage adoption based on seed distribution figures

## Motivation

In spite of the various efforts to introduce improved forages in developing countries there is a lack of evidence of the extent of the adoption of these forages. Given the wide distribution of forages, especially in tropical areas of the developing world, it has been very challenging to document the level of adoption of different forages and the impacts associated with this adoption (Jutzi & Rich 2016).

In many countries, it has been proposed to take advantage of the availability of records on forage seed sales as an indicator of the level of adoption of different forages. Using expected seeding rates, there has been some attempts to convert these seed sales into adoption estimates of the true use of different forages (Holmann et al 2004, Holmann et al 2005). However, in many cases the estimates of adoption using seed sales have not been validated and in other cases there is evidence of an overestimation of the adoption of different forages (Labarta et al. 2017). There are a number of reasons for why the use of seed sales may not offer a direct translation into adoption estimates:

1. Seed sales do not distinguish between using purchased seed for expanding forage area or for replacing old or degraded pastures, resulting, in combination with limited knowledge on reseeding intervals, of imprecise estimates of area-based adoption rates.
2. Seed sales records do not account for own seed production, informal forage seed systems and farmer-to-farmer dissemination, potentially leading to underestimated adoption rates.
3. Usually there is no information on seed germination rate and/or successful rate of establishment
4. Conversions of seed sales into adoption rate do not consider livestock producers’ heterogeneity in seed rates compared to recommended rates.
5. Conversions also do not distinguish dairy, meat production or other orientation of farms
6. Seed sales do not consider livestock producers preferences, forage management and therefore real demand for forage seed and forage cultivars

Although the direct use of seed sales data may help to estimate the relative use levels of different forages, there is a clear need to better understand how seed sales data can be translated into more precise adoption estimates of the relevant forages. The aim of this study is to develop a methodological approach with global applicability. Recognizing differences among production systems across regions and agro-ecologies in the world, we expect to develop a general model that can be easily adapted to different levels of seed system development and to different farming conditions.

## Objectives

* We propose to develop a methodology for estimating the level of adoption of different forages species that builds on the use of seed sales records, but that will be adjusted by livestock producers’ seed management as well as the production and market characteristics faced by these producers.
* Once the methodology is developed, we propose to test the methodology in two cases and validate the conversion of seed sales into adoption estimates by comparing with actual measurement of adoption of different forages.
* With a validated model we expect to identify the key information relevant to the adaptation of the methodological approach to a wider range of regions and production conditions of livestock systems. We will identify opportunities to test the adaptation and application of the approach in at least one further region.

## Proposed activities:

1. We will first identify a group of potential countries suitable for our case studies. The criteria for selecting these will be:
2. Access to records of seed sales
3. Willingness of seed/input dealers to share list of seed buyers in the last two years
4. Countries where CGIAR centres have made investments in making available improved forages
5. Countries where some attempts at estimating forage adoption rates have been made
6. Feasibility to implement field data collection.

From this list of potential candidates we will select the appropriate number of countries for suitable case studies to develop the methodology and to validate the adoption estimates. Operationalising the selection criteria and determining the appropriate number of case studies will be a major activity in the design phase and will shape the final budget allocation needed to implement the overall study.

1. In the identified case studies we will design a sampling framework that will allow us to collect data on seed and farm management from seed buyers in the last two years. The sampling design will include power calculations and a stratification strategy to include different livestock producers by scale and farm specialization. The sample of livestock producers for primary data collection will be drawn from the available lists of seed buyers.
2. We will design the methodology for data analysis and collection based on an extensive literature review of methods to estimate adoption of forages and the methodological approach to combine seed sales records and seed and farm management information to be collected.

Research design and implementation plans will be reviewed after this activity.

1. We will implement the data collection from selected livestock producers in the identified cases and complete a cleaned database for the analysis
2. We will implement the analysis and test the methodological approach in the identified cases and validate its accuracy under different conditions
3. We will discuss analysis results with different stakeholders and disseminate our research findings through publications and oral presentations and identify opportunities for further application of the approach

## Project Outputs

* A methodological approach to estimate adoption of forages using seed sales estimate that can be widely used in the livestock CRP and among partners
* A report on the validation of three cases to estimate the level of adoption of improved forages
* A report on feedback from experts and stakeholders in the livestock sector and plans to implement widely the application of this methodological approach.
* A journal article on the cost effectiveness of using seed sales as a basis to estimate adoption of improved forages in developing countries.

## Calendar of Activities

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Activities\* | Outputs\* | Deliverable format | Phase I | | | Phase II | | | |
| Q3 2017 | Q4 2017 | Q1 2018 | | Q2 2018 | Q3 2018 | Q4 2018 |
| A1 | Selection of three case studies | Report |  |  |  | |  |  |  |
| A2 | Sampling framework | Report |  |  |  | |  |  |  |
| A3 | Development of methodological approach | Report |  |  |  | |  |  |  |
| A4 | Data collection & data cleaning | Database |  |  |  | |  |  |  |
| A5 | Analysis and validation of case studies | Report |  |  |  | |  |  |  |
| A6 | Consultation & dissemination of findings | Report |  |  |  | |  |  |  |

Note: Activities A1, A2, A3, A4, A5 and A6 correspond to the six activities described in detail in the proposed activities section

## Budget

See attached spread-sheet.

## Contributors, roles and person months:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Contributor | Expertise | Contribution to activities and outputs | | | | | | FTE [%] | |
|  | relative to Task | A1 | A2 | A3 | A4 | A5 | A6 | Ph I | Ph II |
| Ricardo\* Labarta (CIAT) | Outcome and impact assessment |  |  |  |  |  |  | (5)1 | (5) |
| Byron Reyes (CIAT) | Outcome and impact assessment |  |  |  |  |  |  | 5 | 10 |
| Stefan Burkart (CIAT) | Socioeconomic and value chain analysis |  |  |  |  |  |  | 5 | 10 |
| Nils Teufel  (ILRI) | Outcome and impact assessment & farming systems |  |  |  |  |  |  | 1 | 2 |
| Juliana Pinillos (CIAT) | Outcome and impact assessment |  |  |  |  |  |  | 10 | 50 |
| Karen Enciso (CIAT) | Socioeconomic and value chain analysis |  |  |  |  |  |  | 10 | 50 |
| Lorena Gomez (CIAT) | Outcome and impact assessment |  |  |  |  |  |  | 8 | 30 |

1Ricardo Labarta’s staff time will be provided by CIAT as in-kind contribution to the project

Primary Experts to contact:

* Michael Peters (Tropical forages programme leader, CIAT)
* An Notenbaert (Tropical forage coordinator for Africa, CIAT)
* Martin Mena (Livestock researcher, CIAT)
* Mauricio Sotelo (Forage seeds expert, CIAT)
* Chris Jones (Feeds and forages programme leader, ILRI)
* Michael Blümmel (Animal nutritionist and forage expert, ILRI)

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Jutzi, S.C. & K.M. Rich (2016) An Evaluation of CGIAR Centers’ Impact Assessment Work on Livestock Related Research (1990-2014). Rome: Standing Panel on Impact Assessment (SPIA), CGIAR Independent Science and Partnership Council (ISPC). 69 pp

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# Current adoption of the dual-purpose groundnut variety ICGV 91114 in India

## Motivation

Groundnut haulms are an important source of high-protein roughage for ruminants in low-rainfall areas where groundnut is an important crop, for instance in West Africa (Ayantunde et al., 2008, 2007; Samireddypalle et al., 2017) and South Asia (Birthal et al., 2011). Consequently, ICRSAT and ILRI embarked on selecting superior varieties of groundnut also for their superior yield and nutritive quality of their haulms, resulting in the registration and release of the variety ICGV 9114, as one of the first ground-nut varieties developed outside the government crop improvement system in India (Blümmel et al., 2012, 2005; ICRISAT, 2009; Nigam et al., 2005). It was initially promoted especially in the South Indian state of Andhra Pradesh (Birthal et al., 2012; Teufel et al., 2011).

However, despite obvious productivity benefits and considerable investments in seed distribution, adoption in the initial focus areas was limited. Adoption rates calculated from distributed seed volumes for the district Anantapur in Andhra Pradesh, which had been targeted for dissemination because of the importance of groundnut there, were difficult to validate by survey (Teufel et al., 2011). It appeared that because groundnut seed distribution was often linked to other government support systems (e.g. crop insurance) and the government’s preference of varieties from its own crop improvement programme, the dissemination opportunities for alternative varieties were limited (Teufel et al., 2011). In addition, promoting a new cash crop variety not only for yield increases but for feed quality of its residues was a novel concept for most stakeholders involved in groundnut improvement programmes.

Recently however, reports from neighbouring states have indicated a renewed interest in this variety. Seed sales through various government agencies appear to have increased considerably, especially in the state of Odisha in eastern India. This provides an important opportunity to gain a better understanding of major supporting and limiting factors at various stages of dissemination and adoption of a superior dual-purpose crop variety.

The main investigation levels and stakeholders to be included in this study will be

* government crop improvement and development programmes (including extension systems), providing support to specific varieties and the framework for other stakeholders
* seed multiplication and dissemination organisations (government, NGO, private-sector, informal), ensuring seed availability
* seed sales and pricing, determining seed access by farmers
* groundnut buyers & oil millers, creating demand for specific qualities and varieties
* groundnut farmers and their organisations, deciding which varieties to adopt

## Objectives

* Establish a framework to investigate and better understand context factors and farmer decisions on adopting superior dual-purpose crop varieties
* Quantify current adoption patterns of ICGV 91114 in Odisha
* Determine the institutional and other context factors supporting and limiting the dissemination of these context factors for the case of ICGV91114 in Odisha
* Identify major community- and household-level characteristics contributing to farmers’ decision on the adoption of ICGV91114.

## Proposed activities

The activities proposed for this study include

1. Establish a value chain analysis framework adjusted to the requirements of the study, i.e. investigating the dual-purpose groundnut value chain with a focus on seed dissemination and adoption
2. Identify representatives of major stakeholders in the groundnut seed, production and processing systems for inclusion in the value chain analysis
3. Implement the dual-purpose groundnut value chain analysis covering the seed promotion and dissemination pathways through various public and private channels, including a retrospective analysis of various promotion decisions (data collection, analysis and synthesis).
4. Develop a sampling frame and analysis design for the state of Odisha for a community-level survey of groundnut variety adoption, considering the heterogeneity of expected adoption as well as institutional and production environments.
5. Implement a representative community-level adoption survey, collecting data on variety adoption, seed access, variety perceptions, production systems, market integration. In previous work on groundnut variety adoption, all major stakeholders (seed distributors, farmers, buyers and oil producers) were confident in being able to identify specific varieties.
6. Determination of representative adoption rates as well as analysis of significant community and household characteristics affecting the adoption process, including disadoption.

## Project outputs

The value chain analysis of the groundnut seed system in Odisha will identify major factors contributing to the successful promotion and dissemination of specific ground varieties with a focus on the particular aspects of dual-purpose varieties. These major factors will relate to government policies, institutional capacities, private sector strength and output market demand characteristics, both for groundnut and livestock products. Although each of these factors is hypothesised to significantly contribute to variety adoption, the interactions between the major factors will be of special interest. Qualitative assessment of the data collected from multiple levels of the value chain will enable deep insights into the complexities and opportunities of the existing groundnut improvement and seed systems, especially in regard to dual-purpose varieties.

The adoption study ofICGV 91114 will provide credible estimates of current adoption rates and an up-to-date characterisation of current adoption patterns, both geographically and in regard to community- and farm characteristics. Furthermore, community-level factors associated with adoption linked to the identified constraining and supporting aspects of the existing seed systems will provide an important contribution to a deeper understanding of how improved dual-purpose crops, a major feed resource in intensifying mixed farming systems for the foreseeable future, can be better disseminated.

## Calendar of activities

The proposed outputs and deliverables are planned along the following time-line:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Phase I | Phase II | | | |
|  | Output | Format | 2017 Q3 | 2017 Q4 | 2018 Q1 | 2018 Q2 | 2018 Q3 |
| A1 | VCA framework | Report |  |  |  |  |  |
| A2 | Identify VC representatives | Data-set |  |  |  |  |  |
| A3 | Implement VCA | Report |  |  |  |  |  |
| A4 | Develop sampling frame and analysis design for adoption survey | Report |  |  |  |  |  |
| A5 | Implement adoption survey | Data-set |  |  |  |  |  |
| A6 | Analysis of adoption survey data and synthesis | Report |  |  |  |  |  |

Note: Research design and implementation plans will be reviewed at the end of phase I, after Q3 2017.

## Budget

See attached spread-sheet.

## Contributors and experts

The main contributors to this study will be:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Contributor | Relevant | Activities | | | | | | FTE [%] | |
|  | expertise | A1 | A2 | A3 | A4 | A5 | A6 | ph I | ph II |
| Nils Teufel (ILRI) | Evaluation and assessment |  |  |  |  |  |  | 3 | 8 |
| Braja Swain (ILRI) | Value chains |  |  |  |  |  |  | 5 | 20 |
| Eunice Kariuki (ILRI) | Data management |  |  |  |  |  |  | 5 | 18 |
| Habibar Rahman (ILRI) | Institutional context |  |  |  |  |  |  | 1 | 3 |
| Legume breeder (CIAT) | Legume seed systems |  |  |  |  |  |  | 1 | 3 |
| Social scientist (ICRISAT) | Institutional economics |  |  |  |  |  |  | 5 | 20 |

In addition, the following primary experts will be contacted:

* M Blümmel (ILRI), animal nutritionist and forage expert
* S Nigam (ex-ICRISAT), groundnut breeder
* P Janila (ICRISAT), groundnut seed systems
* P Birthal (NIAP), production systems economist
* C Jones (ILRI), forage science

## References

Ayantunde, A.A., Delfosse, P., Fernandez-Rivera, S., Gerard, B., Dan-Gomma, A., 2007. Supplementation with groundnut haulms for sheep fattening in the West African Sahel. Trop. Anim. Health Prod. 39, 207–216. doi:10.1007/s11250-007-9009-1

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Samireddypalle, A., Boukar, O., Grings, E., Fatokun, C.A., Kodukula, P., Devulapalli, R., Okike, I., Blümmel, M., 2017. Cowpea and Groundnut Haulms Fodder Trading and Its Lessons for Multidimensional Cowpea Improvement for Mixed Crop Livestock Systems in West Africa. Front. Plant Sci. 8, 1–9. doi:10.3389/fpls.2017.00030

Teufel, N., Johnson, N., Singh, D.K., 2011. The adoption and impact of an improved drought-tolerant, dual-purpose groundnut variety in Southern India, in: 7th Asian Society of Agricultural Economists (ASAE) International Conference 13-15/10/2011. Hanoi, Vietnam.

# Impact of forages adopted in Kenya and Ethiopia

## Motivation

The adoption of planted forages has been a core characteristic of intensifying small-holder dairy systems in Kenya and Ethiopia. This development has been supported by the ILRI gene-bank through the provision of cultivars to the national agricultural research systems for screening and dissemination. A recent representative study on the adoption of planted forages in Kenya and Ethiopia has identified the most commonly grown forages in areas with significant dairy production. In Kenya Napier and Rhodes grass are widely found, while in Ethiopia Sesbania and Napier grass are very popular species. Although it could be argued that within existing environments, dairy intensification is dependent on planted forages, only little is known about how the adoption of planted forages in such systems affects dairy productivity, the farm as a whole and the livelihoods of the farming families. However, this is essential to promote improved forage production more successfully (Pengelly et al., 2004) . While the time requirements for integrating forages into farming systems make randomised control trials difficult, the scope of available adoption data will allow for a selection of suitable communities for comparing various levels of adoption of various species in various settings.

## Objectives

* Determine the contribution of planted forages in intensifying dairy systems
* Quantify effects of adopting planted forages on dairy productivity and farm structure
* Assess livelihood impacts of dairy intensification based on adoption of planted forages

## Proposed activities

This study will collect data on forage and feed management, farm organisation, market integration and livelihood indicators. Although recall data will allow some qualitative insights into development effects of forage adoption, the main analysis will focus on the comparison of farmers with considerable forage adoption with farmers without or with very little forages. Alternative feed sources of dairy farmers are grazing on common lands, collected fodder, crop residues and concentrates. However, the identification of a credible counter-factual sample, i.e. farmers who are statistically similar to the adopting farmers in all aspects except forage adoption, will be a critical challenge in the design of this study. The selection bias, i.e. adopting farmers have adopted because they are different from non-adopters, would be expected to be considerable with technologies that have been promoted for an extended period. However, despite forages having been discussed as a viable development option, not all areas have actually been reached by forage dissemination efforts. The adoption survey results will be able to identify areas with strong forage outreach as well as areas which have so far been neglected in this regard. Assuming that the reasons for identifying outreach areas are not associated with farmer characteristics, this differentiation will provide the basis for identifying a counter-factual. In addition, statistical procedures such as matching techniques and instrumental variables will be employed to increase the explanatory power of the data analysis. Ensuring that the sample includes farmers adopting various technologies associated with intensification (e.g. improved breeds, concentrate feeding, animal health services) will help with determining the specific contribution of planted forages.

In order to capture the considerable variation in intensity levels of dairy production found in both countries, it appears useful to select a pair of contrasting administrative units for sampling in each country. The development stage of dairy marketing has previously been applied successfully as a differentiating criterion. A sample size of 400hh per country, based on a sample cell size of 100hh and a 2x2 design structure (adopters/non-adopters; 2 counties (regions) / country) might be appropriate. Although this would allow the expected variation within cells to be captured it would not allow much room for sub-divisions within cells for more specific comparisons. Nevertheless, a detailed calculation including ICC estimates and specifying minimum accuracy/detectable differences would be required to confirm this sample size as adequate.

## Project outputs

The results of this study will contribute to the limited literature body on the impact of forages on small-holder production; an area which has long been promoted as essential for development but which has seen only limited development investment, perhaps also due to the lack of evidence.

In particular, this study will produce

* A report and a brief on the contribution of planted forages to dairy diets, indicating how essential this contribution is to the introduction of cross-bred dairy animals for improving milk yields
* A journal paper on the reorganisation of farms towards intensifying dairy and away from cash crops to increase land productivity on land-constrained small-holder farms with good market access.
* A journal paper on the contribution of intensifying dairy production to the development of household livelihoods.

## Budget

See attached spread-sheet

## References

Pengelly, B.C., Whitbread, A., Mazaiwana, P.R., Mukombe, N., 2004. Tropical forage research for the future - better use of research resources to deliver adoption and benefits to farmers, in: Whitbread, A.M., Pengelly, B.C. (Eds.), Tropical Legumes for Sustainable Farming Systems in Southern Africa and Australia. ACIAR, Canberra, Australia, pp. 28–37.

# Adoption and impact of improved Napier cultivars

## Motivation

The most widely adopted improved forage in Eastern Africa is Napier grass. However, two diseases, Napier stunt and Napier smut, have considerably reduced productivity for some farmers. The ILRI gene-bank has supplied the Kenyan Agricultural Research Institute (KARI, now KALRO) with cultivars to be screened for disease resistance or tolerance. Out of these, two varieties have been developed, Kakamega 1 and Kakamega 2, which are especially tolerant against smut disease and have therefore proved to be popular with farmers, especially in the intensive dairy areas of central Kenya. However, in-field identification of Napier grass varieties is extremely difficult. This may have contributed to the fact, that neither actual adoption nor farm effects nor household impacts of these improved varieties have yet been determined, whether in comparison to other high-yielding varieties or to traditional varieties. Nevertheless, farmers are aware of different varieties and have expressed their perceptions on specific characteristics and their preferences.

## Objectives

* Quantify adoption of Kakamega 1 and Kakamega 2 varieties of Napier grass in central Kenya.
* Determine varietal differences in forage productivity
* Determine differences in dairy productivity, farm management and household livelihoods between adopting and non-adopting farmers

## Proposed activities

In order to assess the impact of improved Napier grass varieties, the difficulty of determining varieties may actually be an advantage: With neither farmers nor researchers really being sure of which varieties of improved Napier are being grown (planting material is often passed from farmer to farmer, restricting source determination) the design would practically resemble a double-blind test. The approach would be to identify areas with a sufficient density of farmers growing improved Napier in central Kenya and randomly select farmers who report growing improved varieties.

The varieties farmers are actually growing would be determined by DNA finger-printing, the costs of which have been decreasing considerably. The results of the variety determination would initially allow for a comparison of what farmers think they are growing with what they are actually growing. Subsequently, actual adoption rates would be determined as well as factors supporting or limiting adoption at the household level.

Based on the varieties they are growing, farmers would be categorised into adopters and non-adopters of the Kakamega varieties in order to create an efficient design for an impact assessment, assuming that a sufficient number of households would fall into both adopter and non-adopter categories. A household survey would then collect data on variety perceptions, farm management characteristics and household livelihood indicators.

The collected data would allow the estimation of differences in Napier productivity, in feed management, in livestock yields and in household livelihood indicators. They would also show, how far along the impact pathway the positive effects of these specific Napier varieties compared to other improved varieties can discerned. Linking this to the perceptions of farmers on available varieties will help identifying interventions which might facilitate greater uptake of disease resistant.

## Project outputs

The study outputs would allow for an insight into the diffusion of varieties within one of the most important forage crops in Eastern Africa, essential for assessing the potential of further genetic improvements. The farm-level assessment of productivity effects and livelihood impacts would contribute to the understanding of how various technical interventions into intensifying farming systems relate to household benefits, also in comparison to farmer perceptions.

## Budget

See attached spread-sheet.